REMARKS

This application has been carefully reviewed in light of the Advisory Action dated April 22, 2005. Applicant has amended claim 1. Reconsideration and favorable action in this case are respectfully requested.

The Examiner has withdrawn the rejection of claims 1 and 5 under 35 U.S.C. §112. Applicants have found another informality in claim 1 and corrected it to provide antecedent basis for "processing modules".

The Examiner has rejected claims 1-14 under 35 U.S.C. §102(b) as being unpatentable over U.S. Pat. No. 5,828,568 to Sunakawa. Applicants have reviewed this reference in detail and do not believe that it discloses or makes obvious the invention as claimed.

The Examiner has rejected claim 15 under 35 U.S.C. §103(a) as being unpatentable over U.S. Pat. No. 6,718,164 to Korneluk et al in view of Sunakawa, cited above. Applicants have reviewed these references in detail and do not believe that they disclose or make obvious the invention as claimed.

As stated in the previously filed Amendment, the Sunakawa reference shows a system where multiple tasks are executed by a single processor. Some of the tasks may use a unit external to the processor, such as an I/O device, during their operation. The units shown in Figure 1 of Sunakawa include a display unit 31, a floppy disk drive unit (FDD) 32, a hard disk drive unit (HDD) 33, a CD-ROM unit 34, a printer unit 35 and a communication interface unit 36. These units can be placed in a low power state if not being used by a currently executed task (see Figure 3 and column 6, line 53 through column 7, line 2).

In a first embodiment, Sunakawa attempts to reduce overall power consumption by maximizing the time that the units 31-36 are in a low power state. This is accomplished

by increasing the priority of tasks have higher power consumption based upon which units 31-36 are used during execution of the task. The goal is to execute the highest consuming tasks as quickly as possible, since the units used by the task can be placed in a low power state as soon as the task is complete.

An example of this is shown in Figures 5A-B. In Figure 5A, tasks A, B and C are allocated equal, alternating execution time periods. Task C uses more consumption power because it uses I/O unit C (the other tasks do not use an I/O unit). In Figure 5A, task C is finished at time t1 and I/O unit C is placed in a low power mode at time t2. In Figure 5B, task C is given a higher priority in order to complete the task in a shorter period of time. By completing the high priority task in a shorter time period, power to the device (or devices) can be turned off earlier, thereby reducing the power consumed by the device (Abstract, column 8, line 42 through column 9, line 5). Task C is thus completed at time t3 (which occurs earlier than t1) and I/O unit C is placed in a low power state at t4 (which occurs earlier than t2). The savings in power is thus the power consumed by I/O unit C over the time period t2-t4.

In a second embodiment (cited by the Examiner in the last Office Action) initiating a device pursuant to a task is delayed if turning on the device would exceed power limits (column 11, line 38 through column 12, line 9).

In a third embodiment, increased power due to a device's transition from a high-power mode to a low-power mode is taken into consideration when deciding upon whether to place the device in a low power mode once a task's access to a device is complete (column 13, line 48 through column 14, line 34).

In a fourth embodiment, the hysteresis of intervals between accesses to the device is recorded (and averaged). This information is used in the determination of whether a device should transition to a low-power mode after the end of an access (column 17, line 60 through column 18, line 16).

In a fifth embodiment, the transition of a hard disk drive is made with consideration of whether virtual memory is on or off (column 18, lines 17 - 37).

In a sixth embodiment, a transition to a low power mode is made in consideration of a delay time associated with returning to a high power mode (column 18, lines 38-65).

The primary goal of Sunakawa is maximizing the time period in which devices external to the processor can be placed in a low power mode (or, in an alternative phrasing of the statement, minimizing the time that devices external to the processor are in a high-power mode). This is described above in connection with the first embodiment of Sunakawa. In the second embodiment of Sunakawa, as cited by the Examiner, when a task makes an access to a device which is currently in a power-saving mode, the current consumption power of the circuit is detected to determine whether the device can be started. If so, a timer determines the point at which the device is stabilized for use by the task. If the device can not be started due to power considerations, the task which made a request to access the device is changed to a waiting state. When other devices are turned off, freeing up power, the requested device is turned on.

The present invention, as defined by claim 1, has an entirely different goal – to prevent hot spots which can cause failures in a processing circuit. First, temperature-associated information is determined at *various areas* of the processing circuit. In response to *detecting an excessive temperature* at an area associated with a first processing module, parameters for executing tasks on one or more *adjacent* processing modules are modified to reduce the heat generated by the adjacent processing modules. The reduction of heat generated by the adjacent modules affects the temperature at the module with the excessive temperature.

In the Advisory Action, the Examiner states:

> Sunakawa clearly discloses the step of determining temperature-associated information at various areas of a processing circuit, wherein power is temperature-associated information. As

consumption power increases, the temperature of the circuit increases. The heat of this operation causes errors and deteriorates the reliability of the apparatus (col. 2, lines 16-26; col. 8, lines 44-54). Hence determining the consumption power used by a device is used to determine if temperature is exceeded.

Sunakawa further discloses modifying parameters (e.g. priority level) for executing tasks on one or more adjacent processing modules (controller; Fig. 1: 5, 7, 9, 11, 13, 15) in order to reduce heat generated by the adjacent processing modules in response to temperature-associated information indicating an excessive temperature at an area associated with a first processing module (see Abstract; col. 9, line 56 – col. 10, line 35). Wherein, a calculation is made to determine the priority level of each task.

First, there is no disclosure in Sunakawa that teaches or suggests the step of determining temperature-associated information *at various areas* of a processing circuit. Sunakawa determines the *total power required by hardware resourced used by each task* (col. 5, lines 33-44). Each task has a table called a task controller block (TCB) which includes a device list of the devices acquired by the task itself and sub tasks and a total consumption power of the devices acquired by the task (Figure 7, col. 9, line 48 through col. 10, line 2). Figure 8A shows a device list, stating the device ID, the consumption power of the device, the time acquired and which task (either the main task or a sub-task) acquired the device. The total of "consumption power" column is stored in the total consumption field (Figure 8B). Figure 8C illustrates an initial priority for the task, a correction based on the total consumption power of the devices acquired by the task, and a corrected priority value according to a predetermined formula (equation 1, col. 10, lines 30-35).

The total consumption power required by each task provides no information on the temperature of various areas of a circuit. The information used in Sunakawa could not be used to determine if an area associated with a particular processing module had an excessive temperature, nor does Sunakawa suggest that it could. The consumption power calculated by Sunakawa calculates the power consumption of a particular task. Contrary

PAGE 13/16 * RCVD AT 5/25/2005 10:32:14 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:9726649606 * DURATION (mm-ss):08-10

to the Examiner's statement, power consumption by a task cannot be used to determine whether a given temperature had been exceeded. If this was the case, a particular task that had a given overall power consumption would fail every time it was invoked, because Sunakawa will always calculate the same consumption power for the task.

Second, Sunakawa provides no teaching of modifying parameters for executing tasks on one or more adjacent processing modules in order to reduce heat generated by the adjacent processing modules and contributing to the excessive temperature at the first processing module.

The Examiner states that Sunakawa discloses modifying parameters for executing tasks on one or more adjacent processing modules in order to reduce the heat generated by the adjacent processing modules in response to temperature-associated information indicating an excessive temperature at an area associated with a first processing module. First, as stated above, Sunakawa provides no teaching of identifying which processing module has an excessive temperature and, thus, parameters could not be change to affect the heat generated by *adjacent* modules. Second, there is no teaching in Sunakawa that the changing of a priority level is done for any reason other than overall power consumption. Reducing overall power consumption does not necessarily lead to elimination of excessive temperatures – in fact, it could create higher instantaneous temperatures. Applicants found no teaching in Sunakawa that a priority level was changed based on determination of an excessive temperature level. Third, changing the priority level of tasks in Sunakawa is performed without consideration of the location of units affected by the change in priority. A change in priority could just as easily result in adjacent units being used in a manner that would cause more heat in a shorter time period, thereby leading to an even higher temperature in a localized area. Fourth, the location of the various units cited by the Examiner is not even discussed in Sunakawa. It would be impossible to adjust tasks to reduce heat by adjacent processing modules if the location of the processing modules was not even known.

In the second embodiment of Sunakawa, there is no determination of an excessive temperature within an area, only a determination that *insufficient power* exists for turning on an additional device. If a device cannot be turned on, there is no modification of parameters for executing tasks on one or more adjacent modules – the task acquiring the device is placed in a waiting state until enough of the active devices are placed in a low power state (column 12, lines 3-9).

Accordingly, Applicants respectfully request allowance of claim 1 and dependent claims 2-7.

For reasons set forth in connection with claim 1, Applicants respectfully request allowance of claim 8, along with dependent claims 9 – 11, and claim 15.

Claim 12 claims a processing circuit including a plurality of processing modules for executing multiple tasks and circuitry for generating a task allocation scenario for allocating the tasks among the processing modules, estimating temperature-associated information for various locations in the processing circuit and determining whether a temperature threshold would be exceeded if the tasks were to be executed according to the scenario.

As stated above, Sunakawa does not estimate temperature-associated information for various locations in the processing module and, hence, this information could not be used to determine whether a temperature threshold would be exceeded in a particular area. Sunakawa does not change priorities based on whether a temperature threshold would be exceeded. Instead, based on calculations of power consumed by a task, Sunakawa attempts to reduce the overall power used by the apparatus by changing the priority of the execution of the tasks. It is not inherent that changing task priority to reduce overall power consumption will prevent excessive temperatures in a localized area – executing the highest consuming tasks at a higher priority as suggested by Sunakawa would likely lead to *higher* peak temperatures.

Accordingly, Applicants respectfully request allowance of claim 12 and dependent claims 13-14.

The Commissioner is hereby authorized to charge any fees or credit any overpayment, including extension fees, to Deposit Account No. 20-0668 of Texas Instruments Incorporated.

Applicants have made a diligent effort to place the claims in condition for allowance. However, should there remain unresolved issues that require adverse action, it is respectfully requested that the Examiner telephone Alan W. Lintel, Applicants' Attorney at (972) 664-9595 so that such issues may be resolved as expeditiously as possible.

For these reasons, and in view of the above amendments, this application is now considered to be in condition for allowance and such action is earnestly solicited.

Respectfully Submitted,

Alan W. Lintel
Attorney for Applicant(s)
Reg. No. 32478

May 25, 2005
Anderson, Levine & Lintel
14785 Preston Rd.
Suite 650
Dallas, Texas 75254
Tel. (972) 664-9595